

**Cadmium Aquatic Life Ambient Water Quality Criteria
Briefing for Deputy Assistant Administrator
March 23, 2016**

Purpose of briefing: Obtain DAA's approval for publication of the final cadmium criteria document in the Federal Register

I. Overview of 2016 Final Cadmium Aquatic Life Criteria Update

- Current criteria update revises acute and chronic freshwater and estuarine/marine criteria; values were last updated in 2001
- Updated criteria added toxicity test data for 75 new species to an already robust data set; there were no major changes in scientific approach
- Timeline consideration: Oregon Toxics Lawsuit brought by Northwest Environmental Advocates
 - OST is working to meet a pending consent decree with NWEA to propose acute cadmium criteria for Oregon by March 31, 2016 and finalize by January 16, 2017
 - The consent decree and criteria revision were driven by a jeopardy call for salmonids by NMFS for acute cadmium in 2012 and subsequent EPA disapproval of the state's criteria in 2013
 - EPA determined new data were available to evaluate acute toxicity of cadmium, which led to this criteria update
 - The 304(a) national criteria is the basis for this rulemaking; plan to issue final on March 30, 2016, to support development of the March 31, 2016 rulemaking for the state
- Review of the updated criteria document included:
 - Three rounds of Agency Workgroup review
 - External expert peer review (five reviewers)
 - Positive reception; applicable technical recommendations were integrated
 - Public comment period
 - Ten comment letters received (List of commenters attached)
 - Comments from states, industry, NGOs, and other federal agencies (e.g., USGS)

Table 1. Overview of Milestones

Action	Date
Agency Workgroup Review - Draft	4/20/15 – 5/20/15
External Peer Draft Review	8/22/15-10/2/15
Agency Workgroup Review- Revised Draft	11/2/15 – 11/10/15
60 Day Public Comment Period	12/1/15 – 2/1/16
Agency Workgroup Review - Final	3/1/16 – 3/9/16
FRN Publication	3/30/16

Cadmium Occurrence, Uses and Sources of Contamination

- Occurs naturally in the environment at low concentrations, primarily as mineral deposits (e.g., 0.1-0.2 ppm)
- NiCd batteries account for >80% of global consumption; other common industrial uses include pigments, coatings/platings and stabilizers
- More recently used in manufacture of nanoparticles (quantum dots) for photovoltaic devices

(e.g., solar cells and emitters for color displays)

- Primary sources to the environment:
 - Anthropogenic sources account for > 90% of environmental release
 - Major anthropogenic sources: Fossil fuel combustion, cement manufacturing, metal smelting, and phosphate fertilizer application
 - Legacy mining sites (e.g., Colorado) represent localized sources

II. 2016 Cadmium Criteria

- **Acute freshwater and acute and chronic estuarine/marine values decrease slightly, while chronic freshwater value increases slightly from 2001 value**
- The freshwater criteria are represented by hardness equations
 - Equation-based criteria reflect differences in bioavailability, and hence toxicity, of cadmium under different water quality conditions
 - Hardness does not affect cadmium toxicity in salt water
- Acute criteria (CMC) = $e^{(0.9789 \times \ln(\text{hardness}) - 3.866)} \times \text{CF}$
 - Where CF = conversion factor from total to dissolved cadmium, which is close to 1 at 100 mg/L hardness (0.944)
- Chronic criteria (CCC) = $e^{(0.7977 \times \ln(\text{hardness}) - 3.909)} \times \text{CF}$
 - Where CF = 0.909 at 100 mg/L hardness
- The freshwater criteria are captured in the table at a water hardness of 100 mg/L

Table 2. 2016 updated criteria values compared to 2015 draft and existing 2001 current criteria

	2016 Updated Values		2015 FRN Draft Publication Values		2001 Criteria Update	
	Acute (1-hour, dissolved)	Chronic (4-day, dissolved)	Acute (1-hour, dissolved)	Chronic (4-day, dissolved)	Acute (1-day, dissolved)	Chronic (4-day, dissolved)
Freshwater (Total Hardness = 100 mg/L as CaCO ₃)	1.8 µg/L^a	0.72 µg/L	2.1 µg/L ^a	0.73 µg/L	2.0 µg/L ^a	0.25 µg/L
Estuarine/marine	33 µg/L	7.9 µg/L	35 µg/L	8.3 µg/L	40 µg/L	8.8 µg/L

^a Lowered to protect the commercially and recreationally important rainbow trout, as per 1985 Guidelines

Table 3. Number of tested aquatic species included in criteria derivation over time

	Freshwater Acute	Freshwater Chronic	Estuarine/Marine Acute	Estuarine/Marine Chronic
1980	29	13	31	1
2001	65	21	61	2
2016	101	27	94	2

III. Key Document Changes Based on Public Comment Period

- Freshwater acute value decreased from the draft value of 2.1 ug/L to 1.8 ug/L
 - Corrected hardness equation to remove all tests with unmeasured concentrations to ensure validity of results
 - Data for salmonids were revised based mainly on commenter input
 - Insensitive life stages removed
 - High outlier values removed because data outside ten-fold range of acceptability and use of different cadmium salt
 - Low outliers removed due to inappropriate salt used to derive high hardness
- Freshwater chronic value decreased from 0.73 ug/L to 0.72 ug/L due to addition of one test
- Estuarine/marine acute value decreased from 35 ug/L to 33 ug/L due to replacement of nonnative with native test species
- Estuarine/marine chronic value decreased from 8.4 ug/L to 7.9 ug/L based on change in acute test species, and used in the acute-to-chronic criterion calculation

IV. Key Comments/Responses with Limited or No Revisions

- **Comment Topic #1:** Change in acute duration from 24 hours to 1 hour is not adequately justified or supported by new studies and may require additional samples to be collected (Illinois EPA)
 - A one-hour duration is consistent with 1985 Guidelines:
“One hour is probably an appropriate averaging period because high concentrations of some materials can cause death in one to three hours. Even when organisms do not die within the first hour or so, it is not known how many might have died due to delayed effects of this short of an exposure. Thus it is not appropriate to allow concentrations above the CMC to exist for as long as one hour.”
 - One hour duration is consistent with all prior cadmium criteria revisions (1996, 1985, 1980), with the draft version of the 2001 cadmium update, and with all 45 of the other acute values except freshwater copper (which we are correcting)
 - Changing the duration to one hour will not affect the expression of WQBELs; consistent with the NPDES regulations (40 CFR 122.45(d)) and WQBEL derivation procedures (EPA’s TSD guidance). WQBELs would continue to be expressed in terms of Maximum Daily and Average Monthly averaging periods
- **Comment Topic #2:** Proposed criteria are based on a flawed toxicity test conducted on the amphipod *Hyaella azteca*; which is the most sensitive organism tested (FDEP, WDNR)
 - Tests were included based on peer reviewer recommendation
 - Test data quality was reviewed and approved by internationally recognized experts in ORD, USGS, and author of the test method
- **Comment Topic #3:** ESA-related (NOAA/NMFS, Center for Biological Diversity, California State Water Resources Control Board)

- Specific Comment: Criteria must be fully protective of ESA species and must consult with the Services in its criteria recommendations
 - EPA intends to consult with the Services when approving state standards

- Specific Comment: EPA must develop criteria protective of long-lived or sediment ingesting species
 - Most aquatic organisms are considered to be more susceptible to cadmium from direct aqueous exposure, thus the criteria are protective of long-lived and sediment ingesting species

Ex. 5 - Deliberative Process

conservative approach, considering that acute criteria are based on 96-hour continuous concentration laboratory exposure toxicity tests.

Ex. 5 - Deliberative Process

Attachment

Public Comment Period Letters Received

1. Florida Department of Environmental Protection
2. Illinois Environmental Protection Agency
3. Wisconsin Department of Natural Resources
4. Kansas Department of Health and Environment
5. Utility Water Act Group (via Hunton and Williams)
6. Hampton Roads Sanitation District
7. US Geological Survey (Chris Mebane)
8. National Marine Fisheries Service
9. Center for Biological Diversity
10. California State Water Resources Control Board